



Primary Standards Laboratory Metrology Program

AC Electrical

Fact Sheet

The Primary Standards Laboratory (PSL) maintains a wide variety of primary ac electrical standards to insure accurate and traceable measurements for its customers. The AC Project provides services in time and frequency, ac voltage and current, impedance, phase, pulsed high-voltage and current, fast-rise pulse, and waveform digitizer calibrations.

[MJTVC] Systems; and a Pulsed High-Voltage Generator/Calibration System.

The AC Project provides consultation for all its customers in the proper use of calibrated standards, the selection of appropriate new instruments and standards, the solution of problems that arise in the use of this precision equipment, and the application of these instruments to the measurements of weapons components, sub-assemblies, and systems. The project also participates in the survey and evaluation of the performance of DOE/NNSA Contractor Standards Laboratories by using proficiency test items selected by the Primary Standards Laboratory team.

Capabilities

Below is a representative sample of our measurement uncertainties. The NIST/National Voluntary Laboratory Accreditation Program (NIST/NVLAP) accredits us under Lab Code 105002.

For additional details, see <http://ts.nist.gov/ts/htdocs/210/214/scopes/1050020.pdf>.



Pulsed High-Voltage System

Equipment includes very precise, specially designed and commercially produced instrumentation and calibration systems such as: GPS-controlled clocks; temperature-controlled, fused-silica reference standard capacitors; atomic oscillator test set; Digitally Synthesized Source; Precision ac voltage/current calibration system; Automated Inductive Voltage Divider [AIVD] Calibration System; Multi-Junction Thin Film Thermal Voltage Converter

Quantity	Typical Value	Frequency	Uncertainty $k = 3$
Time of Day	Continuous		<100 ns
Frequency	10 MHz		<1x10 ⁻¹²
ac Voltage	0.5V - 100V	10 Hz - 1 MHz	16 - 104 ppm
	100V - 1kV	10 Hz - 100 kHz	21 - 104 ppm
ac Current	10 mA - 20 A	50 Hz - 50 kHz	100 - 170 ppm
ac Impedance	1 kOhm		500 ppm
Inductive Dividers	15, 35 & 100V	60,1 k & 10 kHz	55 ppm
Capacitance	.01 - 1000 pF	1 kHz	1 ppm
	1 - 1000 pF	100 kHz - 1 MHz	0.01 - 1.3%
Inductance	10μH - 10H	100 Hz - 10 kHz	200 - 1100 ppm
	.1μH - 25H	10 kHz - 10 MHz	0.1 - 4 %
Q	95 - 607	50 kHz - 45 MHz	1.2 4.5%
RF-DC Volt Conv	0.5 - 200V	1M - 100 MHz	0.06 - 1.1%
	1 - 7V	300M-1000 MHz	1.3%
μPot	0.1m - 330 mV	30M-900 MHz	0.43 - 5.1%
Pulsed Voltage	350 kV		1.0%
Pulsed Current	500 A		1.0%
Magnetics	1000 G		1.5%

Major Resources

- Precision ac/dc Calibration Systems:
Functionally identical to systems used by NIST for ac/dc transfer measurements
- Time and Frequency System:
Contains GPS clocks, NIST-FMAS, NIST-connected talking clock and time-code distribution system.
Computer clocks can be set over the Internet at NTP addresses:
134.253.8.1; 134.253.8.43;
134.253.8.5
- Computer-controlled, low-frequency impedance measuring system
- Computer-controlled, inductance and capacitance measuring systems
- Computer-controlled, pulsed high-voltage generator (to 350 kV)
- Computer-controlled waveform recorder calibration system



Metrologist Performing an Impedance Measurement

Selected Accomplishments

- Developed thin-film multijunction thermal converters with NIST; fabricated and vacuum sealed devices at Sandia capable of sub-ppm ac/dc difference.
- Worked with NIST to develop new standards for emerging technologies, such as the Digitally Synthesized Source, which provides a method for generating NIST-traceable source of precision ac voltage below 10 Hertz
- Maintain state-of-the art capability for calibration of air dielectric capacitors from 1 kHz to 10 MHz.
- Pioneered the Kerr cell optoelectronic technology used to support pulsed high-voltage measurements.
- Beta tested NIST common view time measurement system

Contacts

Alan R. Mahoney

Sandia National Laboratories
P. O. Box 5800; M/S 0665
Albuquerque, NM 87185-0665
Phone: (505) 845-3295
FAX: (505) 844-4372
Email: armahon@sandia.gov

Thomas F. Wunsch, Ph.D.

Sandia National Laboratories
P. O. Box 5800; M/S 0665
Albuquerque, NM 87185-0665
Phone: (505) 844-4359
FAX: (505) 844-4372
Email: tfwunsch@sandia.gov